Space Weather Technical Forecast

Issued on Friday, 08 July 2022 at 13:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: G1/Minor Geomagnetic Storms likely Day 1 (8th July), with risk decreasing through the period. Slight chance of R1-R2 radio blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with a couple of minor C-class flares. The largest and most recent flare was a C1.5 that peaked at 08/1125 UTC, originating from AR3052 in the northeast quadrant. No Earth-directed CMEs have been observed in available imagery over the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, exhibited the aftermath of a weak CME initially, followed by the weak influence of the HSS originating from CH97/+. The solar wind speed decrease from 410 to 370 km/s initially, with an average density, but started to increase shortly after 08/0000 UTC, the density rising sharply before peaking at 30-35 ppcc around 08/0700 UTC. The IMF was initially strong, around 22nT, but slowly came back to moderate levels during the second half of the period. Equally, the Bz was strongly negative initially, with a peak of -19nT at 07/1342 UTC, but became moderate and largely positive during the second half, now very weak. The phi angle was largely negative (towards the sun) but became mostly positive after 08/0500 UTC. Resulting geomagnetic activity was Unsettled to Active (Kp 3-4) with a few G1/Minor Storm (Kp 5) intervals, between 07/1200-1500 UTC and then later between 08/0000-0600 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES-16, remained at background levels throughout the period. The high energy electron flux (greater than 2MeV) has been mostly at background levels, the corresponding electron fluence constantly declining over the past 24 hours and remaining well below the Active (1e8 integrated pfu) threshold. Observed fluence was 1.53e6 integrated pfu at 08/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain Low with a Slight Chance of isolated M-class flares. An increase is possible from day 3 (10th) as returning regions potentially rotate onto the eastern limb.

Solar Wind / Geomagnetic Activity: Earth may experience a glancing blow from a CME that left the sun on 05 July, from AR3047. This CME was difficult to assess but it gave a faint partial halo in SOHO imagery and as such, a glancing blow is possible late today (8th July), or early tomorrow. Confidence is low though. Solar winds should stay around slightly-elevated levels today, under the influence of CH97/+. However, they may reach elevated levels tomorrow (09th), should the expected CME arrives.

Geomagnetic activity is expected to be Unsettled to Active (Kp 3-4) with G1/Minor Storm (Kp 5) intervals likely today (08th July) due to combined HSS and CME effects. Activity should decline tomorrow (09th) to become mainly Quiet (Kp 0-2) from Day 3 (10 July).

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Energetic Particles / Solar Radiation: In the absence of any significant sunspot development, the high energy proton flux (greater than 10 MeV) is likely to remain at background levels. Probabilities increase very slightly as AR3053 moves towards centre disc.

The high energy electron flux (greater than 2MeV) may increase through this period, however confidence is low. This may result in a gradual increasing trend in the electron fluence, but if this occurs the fluence is still expected to remain below the Active threshold.

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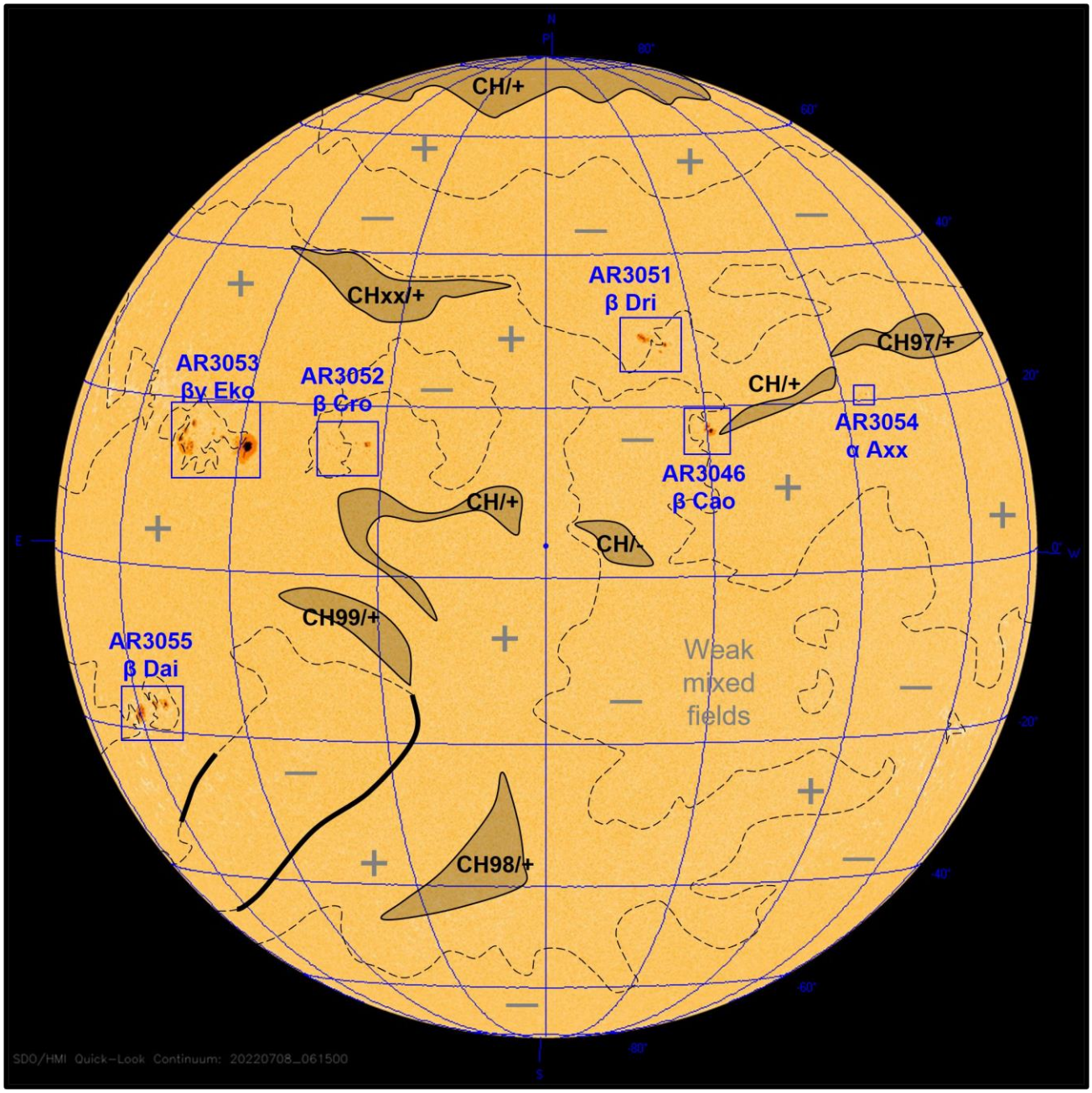
Figure 1. Solar Analysis Valid 08/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Earth may experience a glancing blow from a CME that left the sun on 05 July, from AR3047. This CME was difficult to assess as it was faint and contaminated by a far sided CME which was visible at the same time. However, it gave a faint partial halo in SOHO imagery and as such a low confidence glancing blow is possible late today (8th July) or early tomorrow.

Otherwise, it appears that Earth has recently experienced a weak CME arrival, combined with a weak influence from the HSS from CH97/+. Solar winds should stay around slightly-elevated levels today, under the influence of CH97/+. However, they may reach elevated levels tomorrow (09th), should the expected CME arrives.

Geomagnetic activity is expected to be Unsettled to Active (Kp 3-4) with G1/Minor Storm (Kp 5) intervals likely today (08th July) due to combined HSS and CME effects. Activity should decline tomorrow (09th) to become mainly Quiet (Kp 0-2) from Day 3 (10 July).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	60	20	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
05/0934 UTC	Partial halo	AR3047	SW Quadrant	530 km/s	08/1700 +/- 6hrs	Low confidence - Limited shock expected

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Radio Blackouts - X-Ray Flares:
There are currently six numbered sunspot regions on the visible disc. AR3053 remains the largest and most complex region, with further development of small spots on the trailing group and an intermediate spot with penumbra. This has pushed the magnetic complexity into the beta-gamma category. Another region of importance is AR3055, it has significantly grown in size and complexity in the last few hours, with several additional intermediate spots. It also recently produced some minor flare activity. AR3051 has also shown some slight increase in size and spot number. The other regions are small and stable, seemingly dormant or decaying.

Solar activity is Low, with some minor C-class activity over the past 24 hours. Activity is expected to remain Low with a slight chance of an M-class flare. The figures have been revised upwards due to the recent development of AR3055, but AR3051 and AR3053 make good contenders too.

Bright flux regions are also visible on EUVI/AIA-195 imagery near 110 degrees East, indicating the presence of plages or active regions. These may rotate on the visible disc on day 3 (10th).

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 2: SDO hmi-intensitygram and magnetogram of northwest disc, showing AR3053, the largest and most complex region

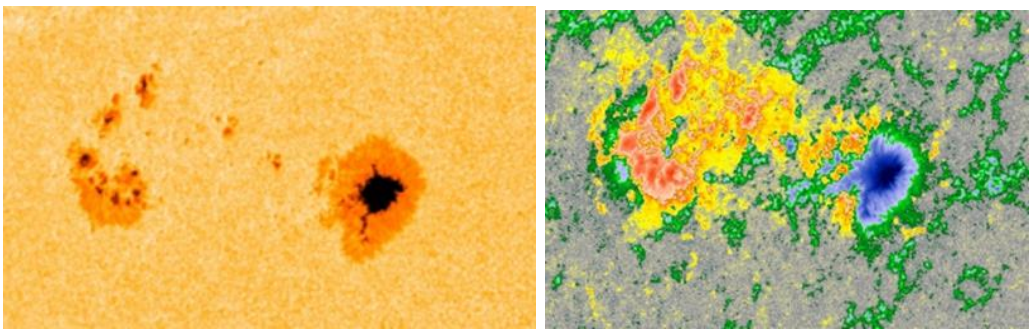

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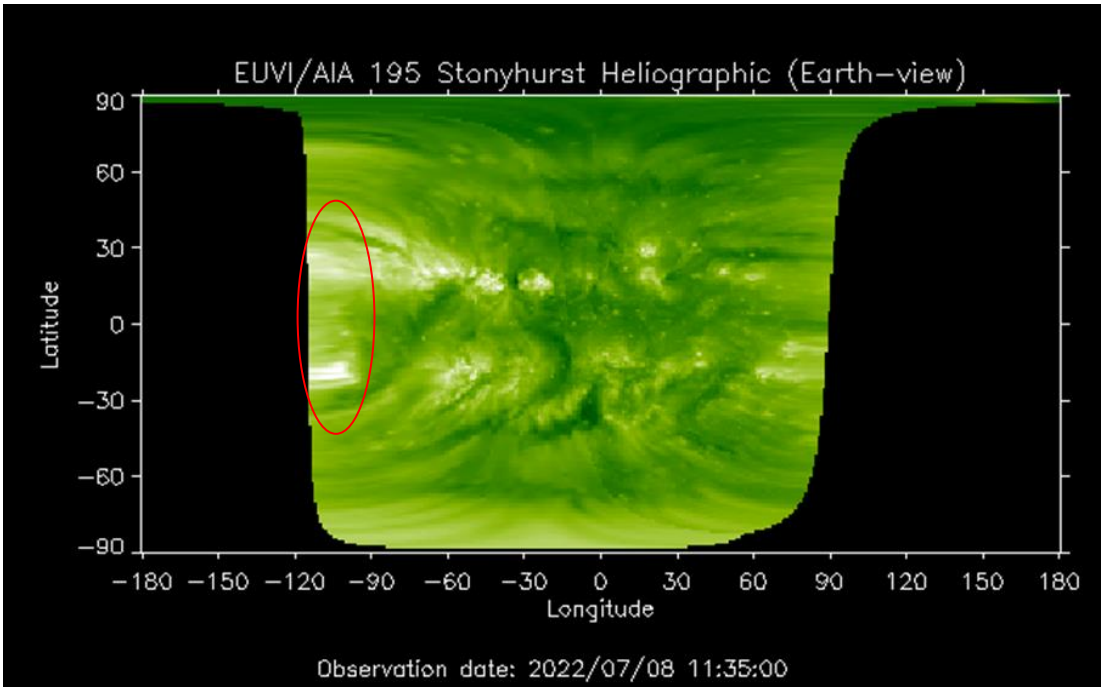
Figure 3: Cylindrical projection of the sun in 195 Angstroms, showing impending bright flux regions over the southeastern and perhaps later northeastern solar horizon, suggesting further emerging sunspot regions in the coming days.



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at background levels, and will most likely remain at this level through the period, in the absence of any significant sunspot development. A slight uptick in probability is suggested on Day 3 (10th July) as AR3053 reaches near centre disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	3	3	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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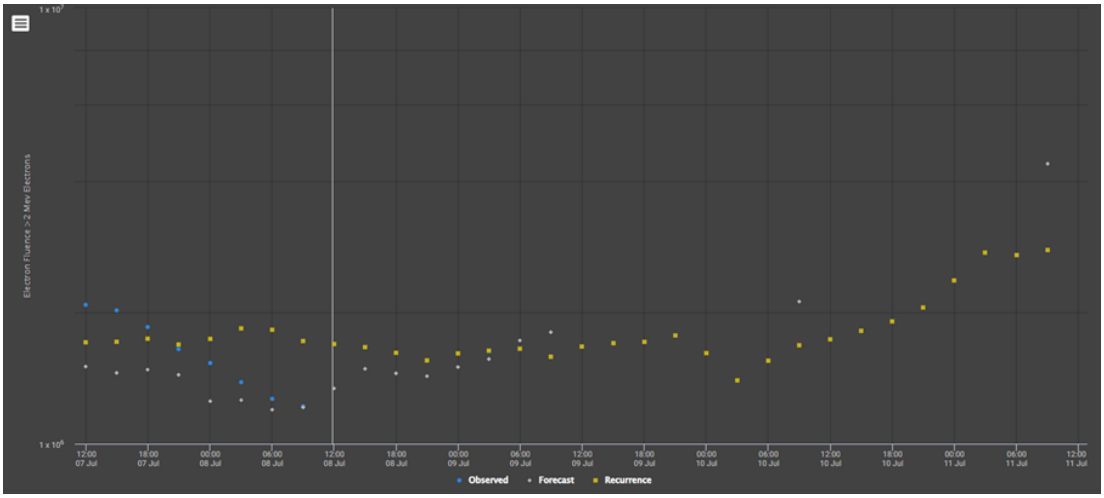
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) is currently at background levels. Electron flux might increase through this period under the influence of a weak HSS. High (1000 pfu) flux levels might be reached during the diurnal maxima later in the period, but confidence is low. Electron fluence is currently well below the Active threshold. An upward trend is possible following the current weak coronal hole connection, but with low confidence for the magnitude of this.

Currently the fluence is expected to remain below the Active threshold. Therefore the Met Office REFM model is considered to be offering good guidance.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\,sr^{-1}\,day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	10	10	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Latest REFM output, considered to give good guidance.



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